Spirometry: Application in practice

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Conflict of Interests Disclosures

- I am on the Speakers Bureau and a trainer for Hill Rom

- I have no conflict of interests with this presentation

Objectives

- Discuss spirometry and assess quality
- Discuss how spirometry and pre-post tests are interpreted
- Review cases to demonstrate the practical applications

Why perform spirometry?

- Add to evidence needed for accurate diagnosis of disease (pulmonary and cardiac)
- Assess response to new medications
- Monitor progression of disease and effectiveness of treatment
- Pre-operative assessment of certain patients
- Worker's compensation claims/disability
- Research

Spirometry is valuable but….

- It does not stand alone
  - It acts only to support or exclude a diagnosis.
- History and physical exam, laboratory data, imaging will help establish a diagnosis.

Importance of objective measurement

- Patients often have inaccurate perceptions of severity of airflow obstruction
  - Asthma patients may be “poor perceivers”…*
- Spirometry provides objective evidence in identifying patterns of disease

Fletcher M; Hiles D. Primary Care Respiratory Journal. 22(4):431-8, 2013 Dec.

Undiagnosed patients?
Suspicion of lung disease?

- Four classic symptoms:
  - Wheezing
  - SOB/DOE
  - Coughing
  - Chest tightness
    - Asthma – all 4 often present
    - COPD – generally excludes chest tightness

NIH➡NHLBI➡NAEPP➡ EPR-3

Expert Panel Review -3*

- Consider a diagnosis of asthma *and performing spirometry* if any of these indicators is present.**
  - Wheezing
  - History of any of the following:
    - Cough, worse particularly at night
    - Recurrent wheeze
    - Recurrent difficulty in breathing
    - Recurrent chest tightness
  - Symptoms occur or worsen in the presence of triggers or allergens
  - Symptoms occur or worsen at night, awakening the patient.

*Eczema, hay fever, or a family history of asthma or atopic diseases are often associated with asthma, but they are not key indicators.

** http://www.nhlbi.nih.gov/health-pro/guidelines/current/asthma-guidelines

How often should you do spirometry?

- When performing the initial assessment
- After treatment has started and symptoms are stabilized –
    - Look for airways to be “near normal”
- Anytime there is a progression downward or a prolonged loss of asthma control
- At least every 1-2 years to assess level of control

NAEPP EPR-3 Guidelines

Spirometry Quality Control – 6 points

- Calibrate the spirometer every day – troubleshoot if not acceptable
- Quality and reproducibility….. Perform at least 3 tests and:
  1. Acceptable tests have no hesitation …BEV < 5% of FVC (a good start of test)
  2. Acceptable tests have at least 6 seconds for exhalation (middle of test)
  3. Acceptable tests reach a plateau (end of test for recording exhalation)

     <25mL change over 1 second

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  4. The 2 best tests have FVC values $\pm$ 150 ml
  5. The 2 best have FEV_1 values $\pm$ 150 ml
  6. The 2 best have PEF $\pm$ 10%

1, 2, 3 are “within” test criteria; 4, 5, 6 are “between” tests

Before and After Bronchodilator Therapy (Pre & post bronchodilator)

- To be called "Significant response to bronchodilator"
  - (+) 12% change and 200 cc increase in FEV_1
  - This is the most "favored" change

……OR ……

  - (+) 12% change and 200 cc increase in FVC

See: Interpretative strategies for lung function tests http://erj.ersjournals.com/content/26/5/948

- % Change =[Post - Pre) / Pre] * 100
  - Expectation is for increased FVC and FEV_1 post tx
    - Note: Decreased volume (FVC) in post measurements could be related to fatigue

- Asthma patients often show significant response (reversible AFO). COPD patients show positive response but not significant unless they have overlap syndrome

Asthma COPD Overlap Syndrome (ACOS)

- Compared to asthma or COPD alone, these patients have
  - More frequent exacerbations
  - Lower quality of life
  - More rapid decline in lung function
  - Higher mortality
  - Consume a disproportionate amount of healthcare resources

- Concurrent doctor-diagnosed asthma and COPD has been reported in between 15 and 20% of patients
  - If the differential diagnosis equally balanced between asthma and COPD (i.e. ACOS) the default position should be to start treatment accordingly for asthma

Diagnosis of Diseases of Chronic Airflow Limitation: Asthma, COPD and Asthma-COPD Overlap Syndrome (ACOS) 2014 http://www.goldcopd.org/asthma-copd-overlap.html

When interpreting…..

- Review the demographics
  - Age, height, gender, race, weight
- Check the symptoms
  - Cough (dry?), SOB, wheezing, chest tightness
  - Any patterns? Seasonal, occupational?
- When was the last time they had a SABA? LABA? ICS?
- Look over the history and chief complaint
  - Smoker? Pack yrs? Include pipe, cigar, waterpipe (hookah)
  - Comorbidities?

When interpreting

- Read the comments made by the person coaching the test
  - “C/O chest pain”
  - “Frequent coughing”
  - “Unable to perform test, unable to follow instructions”
- Look at the graphs
- Study the numbers and check against the predicted values
- <80 % predicted or <LLN to define abnormalities

Differential diagnosis of asthma

- COPD
- Congestive heart failure
- Pulmonary embolism
- Upper Airway Cough (UAC)
- GERD
- Vocal cord dysfunction
- Cystic fibrosis
- Pulmonary infiltration with eosinophilia
- Cough secondary to drugs (i.e., ACE inhibiters)
- Allergic bronchopulmonary aspergillosis
- Churg-Strauss syndrome
- Malignancy obstruction of the airways

Case to consider: DC (PMH, HOPI)

- July visit to the outpatient clinic
- 47 yr old, 5’4” 141 lbs

98.4° F	123/80	14	70

- Has been told she has asthma2 years ago - severity unknown
- Has no C/O wheezing
- C/O chest tightness 3-4 days/wk
- Daily productive cough, more at night
- Currently bilateral wheezing

Case: DC

- Never smoked
- Occupational exposure:
- Works at grocery store. C/O increased symptoms when cleaning crew is running propane-powered floor cleaning machine
- Allergies: pollen, smoke, cleaning products
- No family history of asthma, no c/o GERD

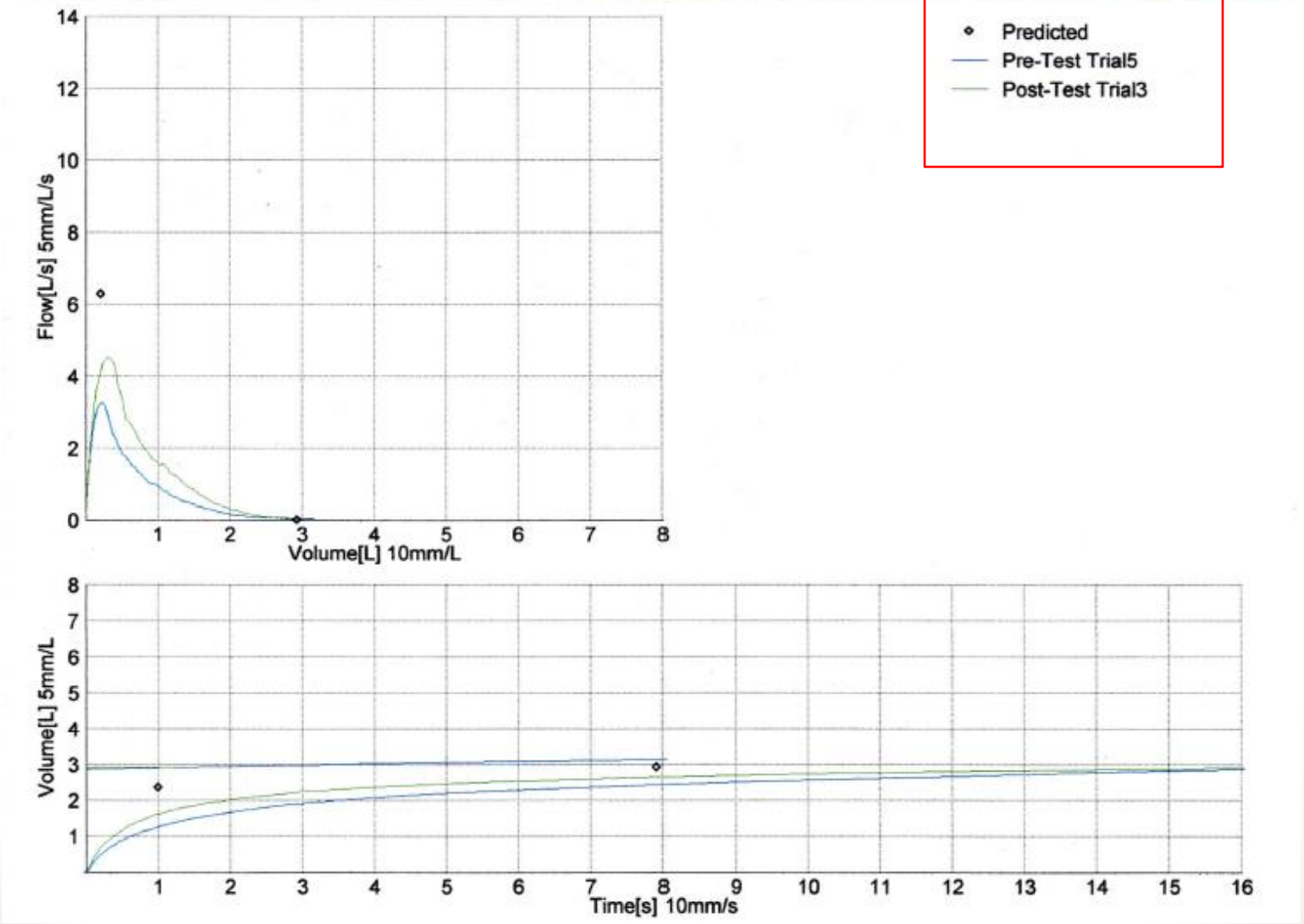
Case: DC

- Current medications:
- Albuterol MDI - 2 puffs PRN (also has albuterol nebulizer)
  - Using both several times daily, last used 7 hours prior to visit
- Tried Advair once – caused facial swelling so she stopped using
  - Was not taking this long enough to know if there was any benefit

Case: DC

- Based on history and what was discussed, questions to consider:
  - Confirm asthma, consider severity
- PFT was recorded – we found obstruction; tx with albuterol, wait 15 min and measured post to have the Pre/post evaluation
  - last had albuterol 7 hours prior to testing

Case: DC - Pre/post



Case: DC

Patient Information

Name	DC
ID	
Age	47
Height	5 ft 4 in
Weight	141 lbs,BMI 24.4
Gender	FEMALE
Ethnic	AFRICAN
Smoker	NO
Asthma	YES

Test Information

Test Date/Time	07/09/2014 11:01am
Post Time	11:47am
Test Mode	DIAGNOSTIC
Syst. Interpret.	NLHEP
Predicted Ref	Nhanes III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

Parameter	Pre-Test Best	Trial5	Trial3	Trial4	Pred	%Pred
FVC[L]	3.15	3.15	3.02	2.84	2.93	108
FEV1[L]	1.30*	1.28*	1.24*	1.30*	2.37	55
FEV1/FVC[%]	41.1*	40.7*	41.2*	45.7*	82.0	50
PEF[L/s]	3.28*	3.28*	3.05*	2.83*	6.30	52
FEF25-75[L/s]	0.25*	0.25*	0.21*	0.28*	2.55	10
FET[s]	23.92	23.92	23.75	19.30	-.--	--

* Indicates Below LLN or Significant Post Change

Case: DC

Post-Test

	Best	Trial3	Trial2	Trial1	Chg
FVC	2.94	2.94	2.82	2.73	-7%
FEV1	1.63	1.63	1.55	1.52	26%
FEV1%	55.6	55.6	54.8	55.5	
PEF	4.51	4.51	4.27	4.03	38%
FEF25-75	0.58	0.58	0.47	0.53	134%
FET100%	17.23	17.23	17.35	15.66	

FEV1 % Predicted 69%

FET 100% dropped from 23.92 to 17.23 sec

Significant change?

NHLBI Full Report of the Expert Panel 2007

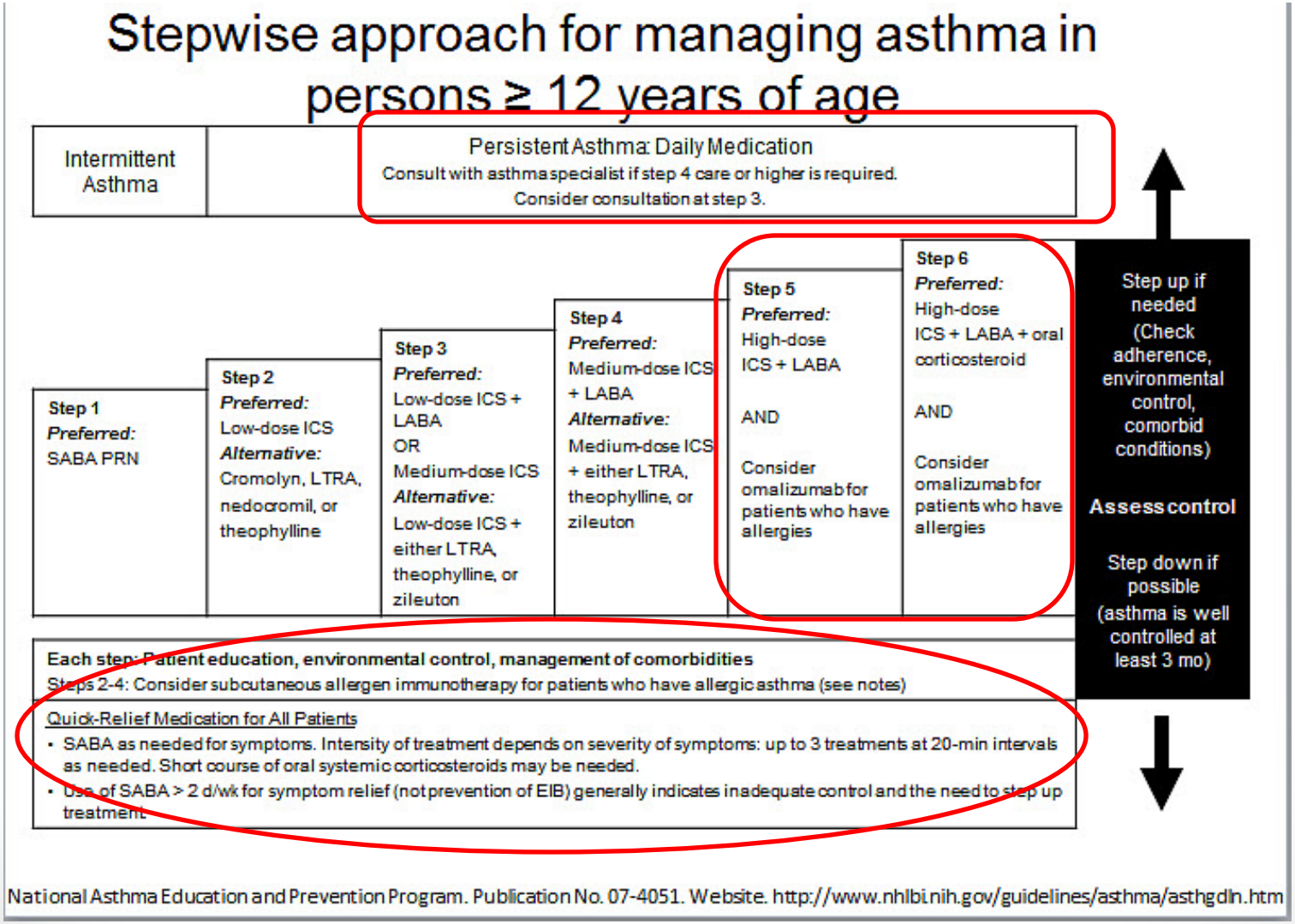
NAEPP EPR-3 Classification of Asthma Severity & Control in Youths ≥12 Years and Adults

Classifying Asthma Severity & Initiating Treatment

Components of Severity		Classification of Asthma Severity			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment Normal FEV_1/FVC: 8-19 yr 85% 20-39 yr 80% 40-59 yr 75% 60-80 yr 70%	Symptoms	≤ 2 days/week	> 2 days/week but not daily	Daily	Throughout the day
	Nighttime Awakenings	≤ 2x/month	3-4x/month	> 1x/week but not nightly	Often 7x/week
	SABA Use (other than for EIB)	≤ 2 days/week	> 2 days/week but not daily and not more than 1x on any day	Daily	Several times/day
	Interference with Normal Activity	None	Minor limitation	Some limitation	Extremely limited
	Lung Function	Normal FEV_1 between exacerbations			
	FEV_1	> 80% predicted	≥ 80% predicted	>60% but < 80% predicted	< 60% predicted
	FEV_1/FVC	normal	normal	reduced 5%	reduced > 5%
Risk	Exacerbation requiring OSC	0-1/year	≥ 2/year	≥ 2/year	≥ 2/year
		Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time. Exacerbations of any severity may occur in patients in any severity category. Relative annual risk of exacerbations may be related to FEV_1			
Recommended Step for Initiating Therapy *The stepwise approach is meant to assist, not replace, the clinical decision making required to meet individual patient needs.*		**Step 1**	**Step 2**	**Step 3** *AND* Consider **OSC**	**Step 4 or 5** *AND* Consider **OSC**
		In 2-6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.			

Case DC – Plan of care

- Severe persistent asthma



Case: DC Interpretation and Plan

Classification = Severe persistent asthma

- Education provided on asthma facts, pathology, triggers
- Education provided on exacerbations, all medications, devices, and technique
- Discussed exercise/activities and strategies

Case: DC Plan

- Medications
  - Continue albuterol products (MDI or nebulizer) PRN
  - Start budesonide/fomoterol MDI 160/4.5, 2 puffs, BID
    - Could have also used Fluticasone/Salmeterol 500/50 1 puff BID
- Get influenza vaccination and repeat annually
- Asthma Action Plan prepared and given to the patient (copy kept in the chart)
- Follow-up scheduled for 4 weeks

New Case to consider : GK (PMH, HOPI)

- April visit to the outpatient clinic
- 54 yr old 5'1" 218 lbs (BMI 31.6)

98.3° F	116/77	16	88

- Dx given to us: COPD- First visit to Pulmonary clinic
- C/O wheezing daily – almost constant
- Chest tightness daily, DOE and at night
- Daily prod cough white to yellow, moderate amt. sputum

Case: GK

- 40 yr h/o smoking ~ 2 ppd, now at ~ 1 ppd
- Currently expiratory wheezing bilaterally
- Sleep issues
  - Subjective score on 1 to 10 scale = 2
  - ~ 50% of issues are with respiratory cause
- Occupational exposures to construction dust, fumes, cleaning tanks used in shipping liquids

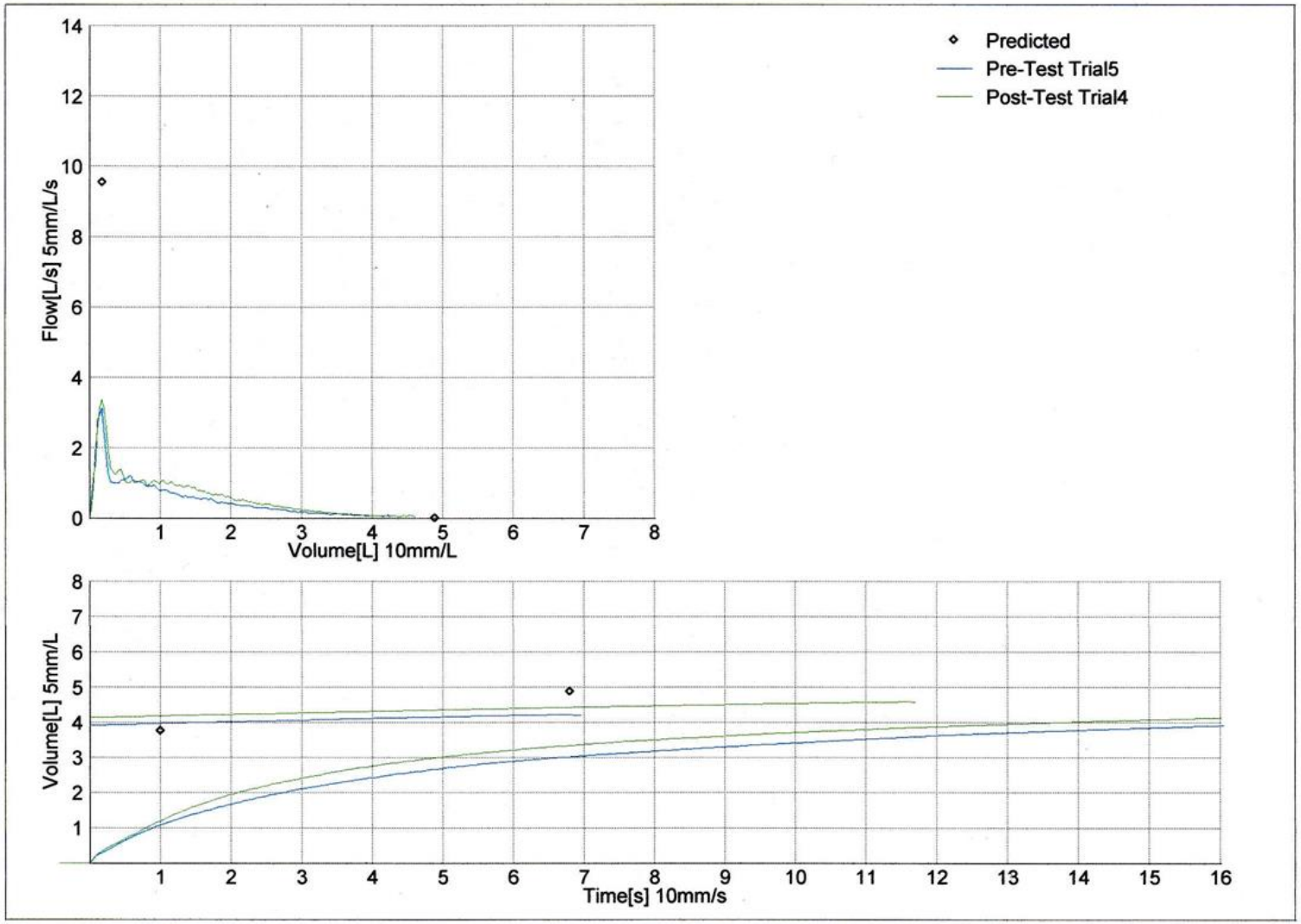
Case: GK (PMH, HOPI)

- Allergies: fumes, perfume, aerosol
- No C/O GERD
- Current medications: albuterol nebulizer PRN
  - Using daily 4-6 x a day
- Fluticasone/Salmeterol diskus. Not sure of the strength. Using 1 x a day to make it last (can't afford $300 inhaler each mo.)

Case: GK

- Based on history and what was discussed, questions to consider:
  - Confirm COPD, consider severity
  - Investigate Asthma COPD Overlap Syndrome (ACOS) due to allergies
- PFT recorded – then tx with albuterol, wait 15 min and measured post to have the Pre/post evaluation

Case: GK spirometry



Case: GK - Pre bronchodilator

Parameter	Pre-Test Best	Trial5	Trial3	Trial4	Pred	%Pred
FVC[L]	4.30	4.24	4.30	4.08	4.90	88
FEV1[L]	1.09*	1.09*	1.01*	1.05*	3.76	29
FEV1/FVC[%]	25.40*	25.80*	23.53*	25.80*	76.9	33
PEF[L/s]	3.13*	3.13*	3.28*	3.05*	9.55	33
FEF25-75[L/s]	0.31*	0.31*	0.31*	0.32*	3.24	9
FET[s]	22.80	22.80	22.85	21.24	-.--	--

* Indicates Below LLN or Significant Post Change

Pre-Test	FEV1 Var=0.04L 3.8%;FVC Var=0.07L 1.6%;Session Quality A
Post-Test	FEV1 Var=0.03L 2.7%;FVC Var=0.09L 2.0%;Session Quality A
Syst. Interpret.	Severe Obstruction

Case: GK Post bronchodilator

Post-Test	Best	Trial4	Trial3	Trial2	Chg
FVC	4.61	4.61	4.51	4.31	7%
FEV1	1.21*	1.21*	1.18*	1.02*	11%
FEV1%	26.30*	26.30*	26.11*	23.76*	
PEF	3.37*	3.37*	3.01*	3.18*	8%
FEF25-75	0.35*	0.35*	0.34*	0.35*	15%*
FET 100%	27.64	27.64	25.83	23.58	

*Post FEV_1 % predicted = 32%
FEV_1/FVC unchanged

*Note GOLD classification for Very Severe is FEV_1 % pred <30%

Case: GK Interpretation and Plan

- Pre-Post shows severe COPD (GOLD criteria:
    - FEV_1% predicted 30 - 50 with daily symptoms in cough, wheeze)
- Positive response to bronchodilator but not significant (did not reach the 12 % and 200 ml increase in FEV_1)

Case: GK

- **Pulmonary Plan:**

*COPD disease education

* Encourage flu vaccination

*Review triggers

*Discuss exacerbations

* Review medications (delivery devices, frequency, dose, technique)

- Smoking cessation plan and tips
- Lose weight (BMI 31.6)
- Possible OSA: offer sleep screen with auto-titrating CPAP

Case: GK Pulmonary Plan

- Medications:
  - Change albuterol to albuterol/ipratropium SMI
  - Change LABA/ICS to budesonide/fomoterol MDI 160/4.5, 2 puffs, BID (Why Δ? Questionable inspiratory flow for diskus)
  - Start varenicline protocol and set quit date for 1 week after starting
  - Begin drug assistance plan (DAP) for all medications
- Schedule follow-up visit in 3 weeks

Case: GK
2nd Follow up (early May)

- Review of symptoms
  - All issues are improved but still present (daily wheeze, SOB, cough, sleep quality better but only a 3-4 from a possible score of 10
- Medications
  - Taking all as ordered (SABA/SAMA via SMI, LABA/ICS, varenicline)
  - Technique is acceptable for inhalers

Case: GK (2nd follow-up)

- Discussed sleep issues and possible CPAP
- Still smoking on full dose varenicline
- Plan –
  - Continue all current medications - restock until DAP starts
  - Add tiotropium bromide Ṫ inhalation once a day
  - Stop smoking!
  - Lose weight
  - Follow up in 1 month

Case : GK- 3rd Follow-up (early June)

- Review of symptoms
  - All issues are much improved (wheeze, SOB, cough) except sleep quality
- Medications
  - Taking all as ordered (SABA/SAMA SMI, LABA/ICS, varenicline, tiotropium)
  - Technique is acceptable for inhalers

Case: GK (3rd follow-up)

- Discussed sleep issues and possible CPAP
- Smoking: now down to 7 cig/day on full dose varenicline
- Plan –
  - Continue all current medications
  - Stop smoking!
  - Lose weight –consider sleep issues
  - Follow up in PRN

New Case: SR

- June visit to the outpatient clinic
- 38 yr old 5’6” 233 lbs (BMI 37.9)

97.9° F	153/100	22	68

- Dx Mild persistent asthma – follow up visit
  - Last seen 14 months ago
- Wheezes “When exposed to triggers”
- Chest tightness “ “ “ “
- Sometimes prod cough white to yellow, moderate amt. sputum

Case:SR

- Never smoked
- Currently clear bilateral BS
- Sleep loss: “N/A” – no issues noted
- Occupational exposures –(blank…nothing written on our form)
- Allergies: cats, some breeds of dog, pollen, cold, exercise, sulfites
- PATIENT IS ALLERGIC TO ALBUTEROL SULFATE

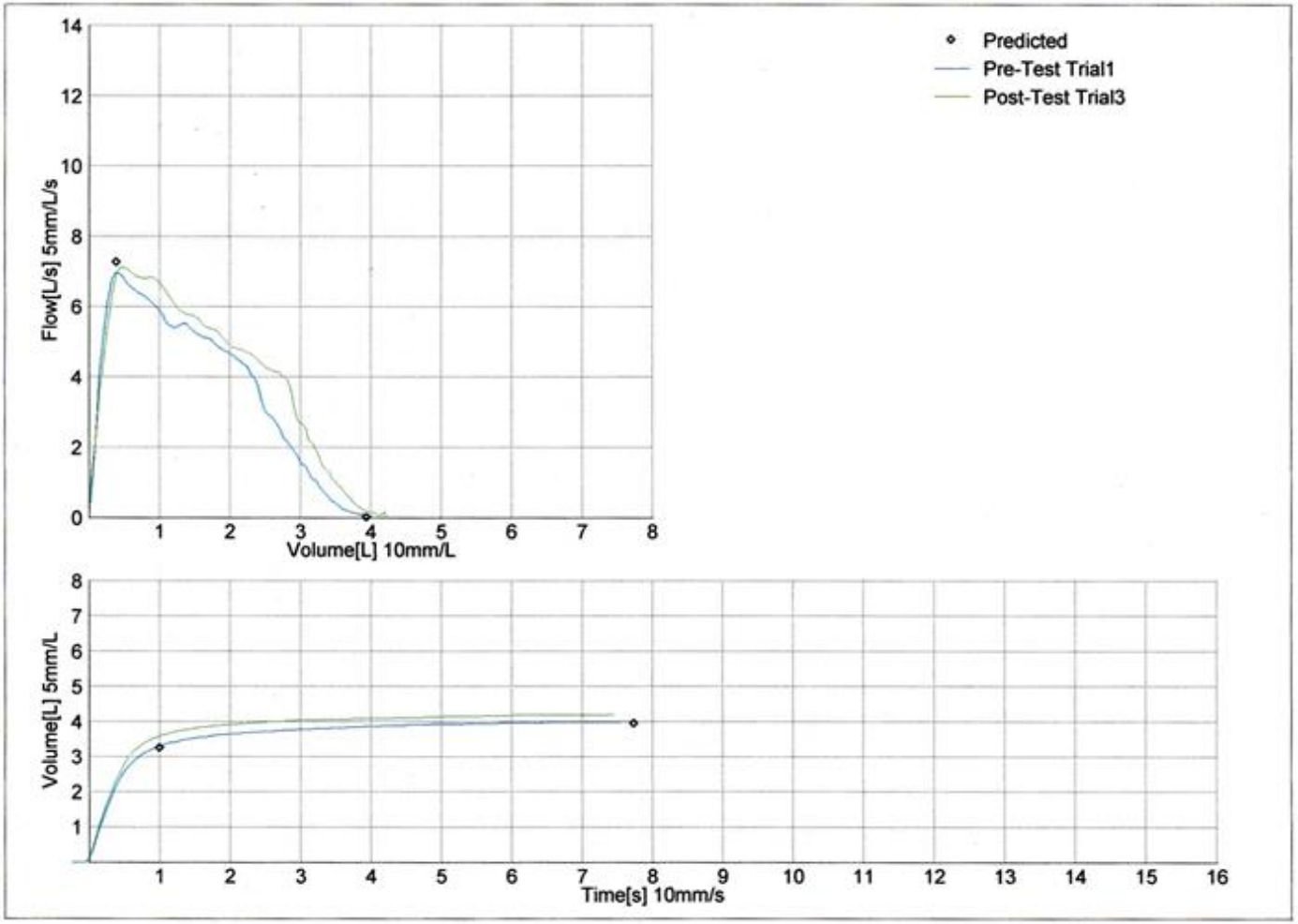
Case: SR

- Current medications: Fluticasone 110, 1 puff BID (no note as to how this is really being used)
- Taking an OTC medication (combination antihistamine and nasal decongestant) PRN for allergies

FVC Test Results

Your FEV1 is 102% Predicted (Post-Test FEV1 111% Predicted)

Parameter	Pre-Test Best	Trial1	Trial2	Trial3	Pred	%Pred	Post-Test Best	Trial3	Trial1	Trial2	Chg
FVC[L]	4.00	4.00	3.93	3.80	3.94	101	4.23	4.20	4.23	4.06	6%
FEV1[L]	3.32	3.32	3.27	3.23	3.24	102	3.60	3.60	3.56	3.45	8%
FEV1/FVC[%]	82.9	82.9	83.3	84.9	82.9	100	85.0	85.6	84.1	85.1	
PEF[L/s]	6.99	6.99	6.70	6.70	7.27	96	7.13	7.13	7.46	7.38	2%
FEF25-75[L/s]	3.71	3.71	3.70	3.88	3.34	111	4.38	4.38	4.15	4.23	18%*
FET[s]	7.74	7.74	8.13	6.87	-.--	--	7.37	7.37	7.25	6.92	



SR: Interpretation and plan

- Spirometry shows no Air Flow Obstruction (AFO)
- Some (+) response to SAMA, not significant (Ipratropium was used)
- The interview did not give us the symptoms/wk (this was missed when one of the faculty worked with the pt –not one of our usual professionals):Hard to place in EPR-3 guidelines due to interview
- Plan: Dulera 200/5 1 puff BID

  Atrovent HFA 2 puffs PRN

  Begin walking for exercise (pre-treat with SAMA)

  Lose weight (currently 233 lbs, BMI 37.9, IBW 135 lbs)

  Follow-up in 3 weeks – she never returned to see us….

- IBW – 105 + 5 (Act height (in) – 60)

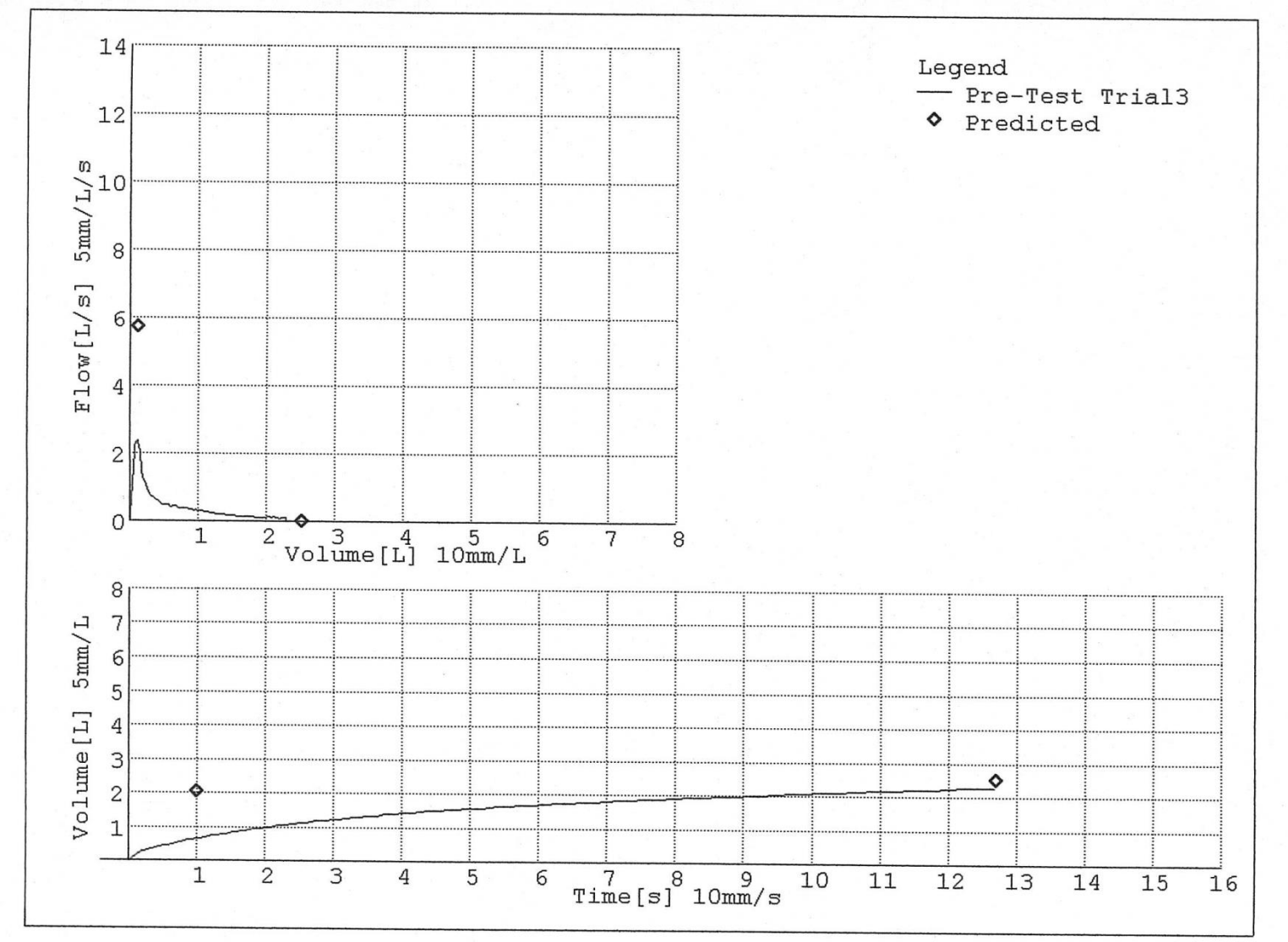
New case to consider: BW

- 46 year old female: 5’0”, 116 lbs. Vital signs- early HTN
- Says she has been told she has asthma (since 16)
  - Prod cough 5-6 days a week, more in AM
  - Daily wheezing, has chest tightness 6-7 days a week, more at night
  - Sleep: c/o cough, wheeze at night ~ 5-6 times a week
  - DOE
  - Faint bilateral I&E wheezes
  - Has GERD
- 30 pk/yrs smoking. Quit 2 months ago. Recent hospital admt for pneumonia
- Allergies: NKDA. Triggers: pollen, dust, dogs, cleaning products

Case: BW

- Occupational: works as a housekeeper at hotel
- Family: Father, sister, 2 granddaughters have asthma
- Using albuterol 2 inh PRN plus nebulizer (several times each day). Takes Zyrtec (cetirizine)as needed during pollen seasons
- Last used albuterol at 1 AM (9 hrs prior to testing)

Case: BW


Legend
Pre-Test Trial3
Predicted
Flow[L/s] 5mm/L/s
Volume[L] 10mm/L
Volume[L] 5mm/L
Time[s] 10mm/s

Case: BW

Patient Information

Name	
ID	Teaching case 8
Age	46
Height	5 ft 0 in
Weight	130 lbs, BMI 25.5
Gender	FEMALE
Ethnic	AFRICAN
Smoker	FORMER
Asthma	YES

Test Information

Test Date/Time	10:43am
Post Time	--:--
Test Mode	DIAGNOSTIC
Interpretation	NLHEP
Predicted Ref	NHANES III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

Test Results

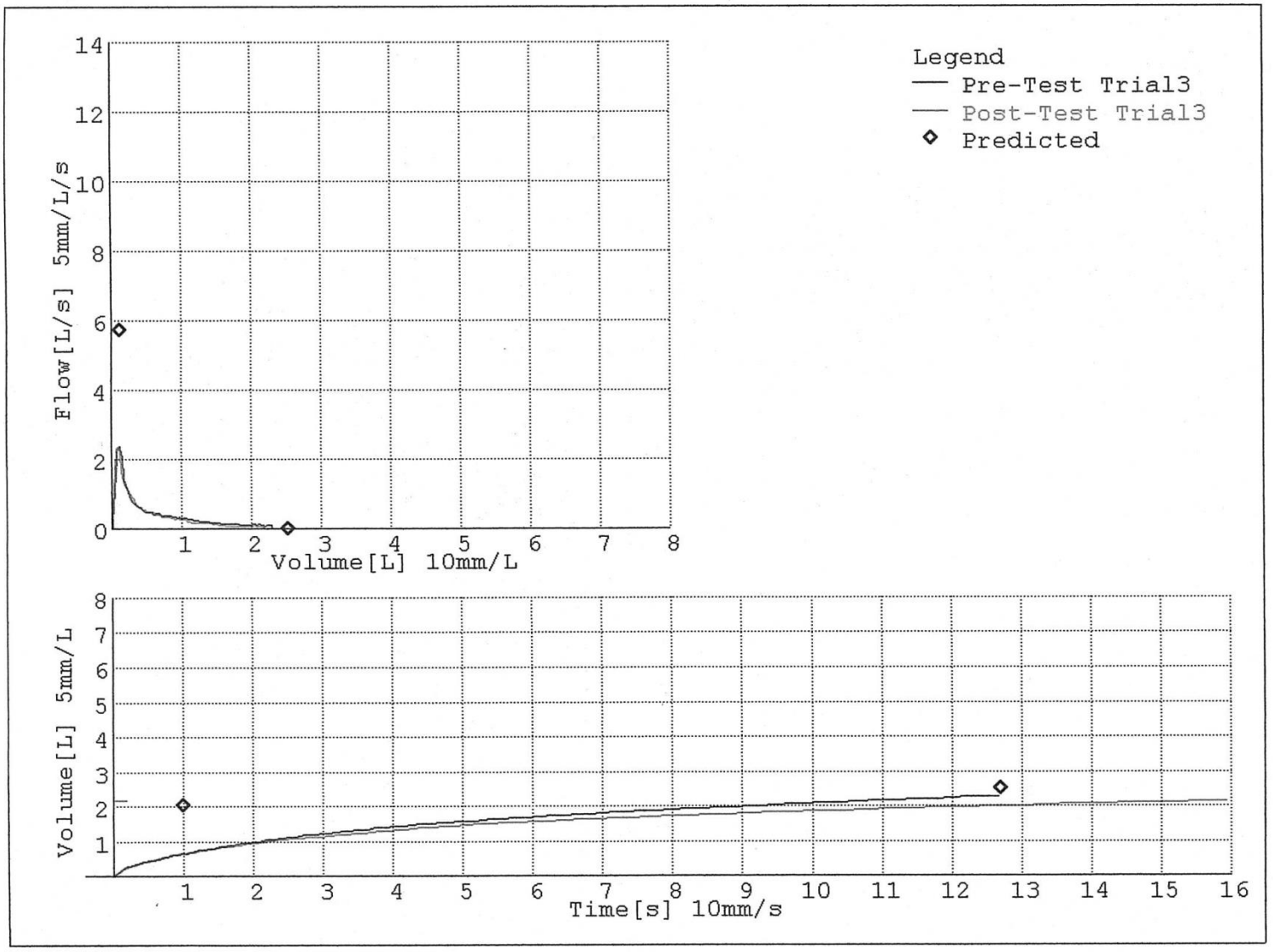
Your FEV1 is 32% Predicted

Parameter	Pre-Test Best	Trial3	Trial2	Trial1	Pred	%Pred
FVC[L]	2.29	2.29	2.25	2.14	2.52	91
FEV1[L]	0.66*	0.66*	0.59*	0.60*	2.05	32
FEV1/FVC	0.29*	0.29*	0.26*	0.28*	0.82	35
FEF25-75[L/s]	0.21*	0.21*	0.18*	0.19*	2.32	9
FET[s]	12.70	12.70	14.79	14.24	-.--	--

* Indicates Below LLN or Significant Post Change

Pre-Test Interpretation	FEV1 Var=0.07L 10.4%; Severe Obstruction	FVC Var=0.04L 1.8%;	Session Quality A

Case : BW


Legend
Pre-Test Trial3
Post-Test Trial3
Predicted
Flow[L/s] 5mm/L/s
Volume[L] 10mm/L
Volume[L] 5mm/L
Time[s] 10mm/s

Case: BW

Patient Information

Name	
ID	Teaching case 8
Age	46
Height	5 ft 0 in
Weight	130 lbs, BMI 25.5
Gender	FEMALE
Ethnic	AFRICAN
Smoker	FORMER
Asthma	YES

Test Information

Test Date/Time	10:43am
Post Time	11:24am
Test Mode	DIAGNOSTIC
Interpretation	NLHEP
Predicted Ref	NHANES III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

Test Results Your FEV1 is 32% Predicted

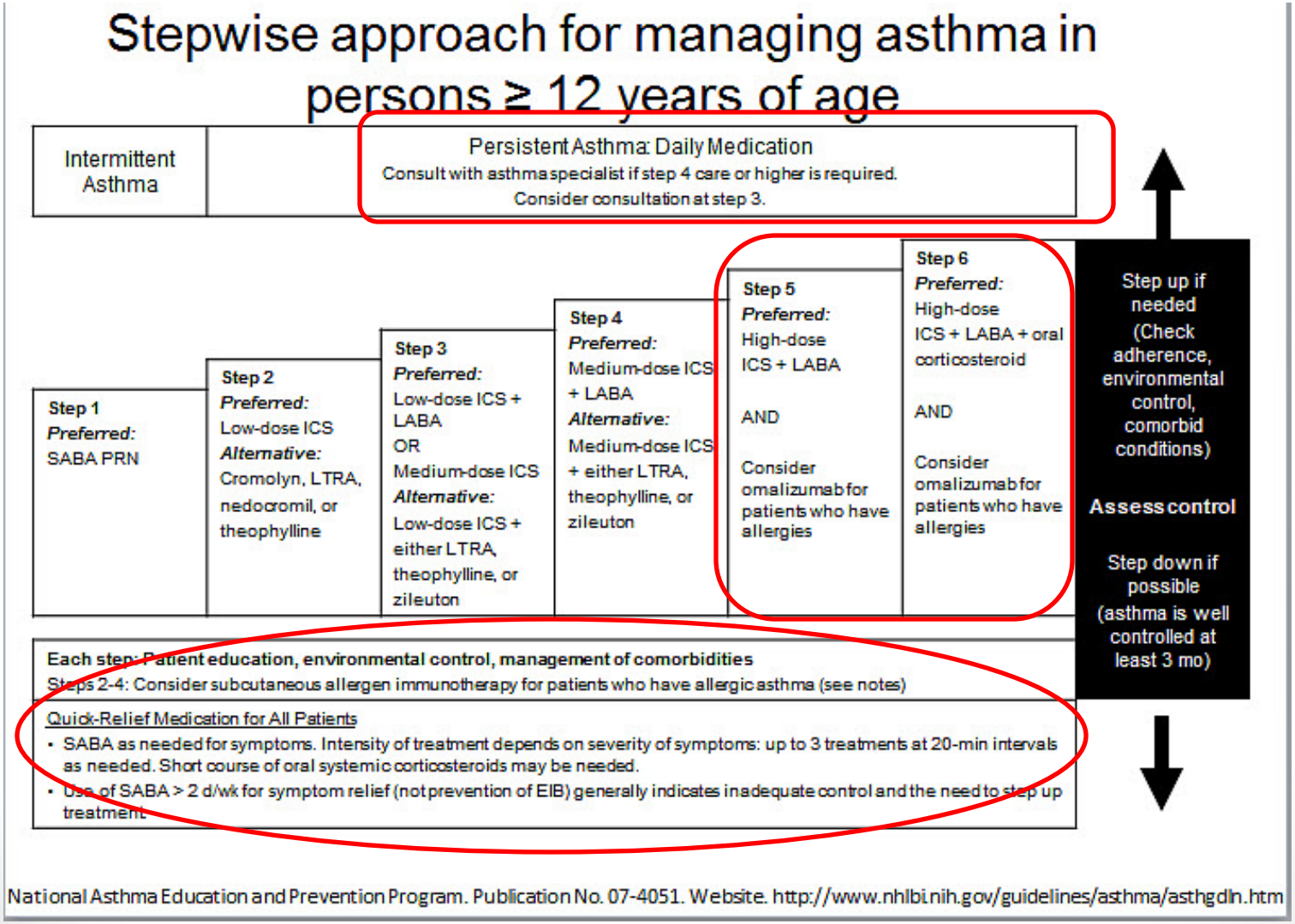
	Pre-Test						Post-Test				
Parameter	Best	Trial3	Trial2	Trial1	Pred	%Pred	Best	Trial3	Trial1	Trial2	Chg
FVC[L]	2.29	2.29	2.25	2.14	2.52	91	2.17	2.17	2.14	2.07	-5%
FEV1[L]	0.66*	0.66*	0.59*	0.60*	2.05	32	0.69*	0.67*	0.69*	0.66*	3%
FEV1/FVC	0.29*	0.29*	0.26*	0.28*	0.82	35	0.32*	0.31*	0.32*	0.32*	
FEF25-75[L/s]	0.21*	0.21*	0.18*	0.19*	2.32	9	0.18*	0.18*	0.23*	0.19*	-14%*
FET[s]	12.70	12.70	14.79	14.24	-.--	--	16.22	16.22	14.10	14.36	

* Indicates Below LLN or Significant Post Change

Pre-Test	FEV1 Var=0.07L 10.4%;	FVC Var=0.04L 1.8%;	Session Quality A
Post-Test	FEV1 Var=0.02L 2.5%;	FVC Var=0.03L 1.2%;	Session Quality A
Interpretation	Severe Obstruction		

Case: BW – plan of care

- Severe persistent asthma, possible COPD (Overlap Syndrome)



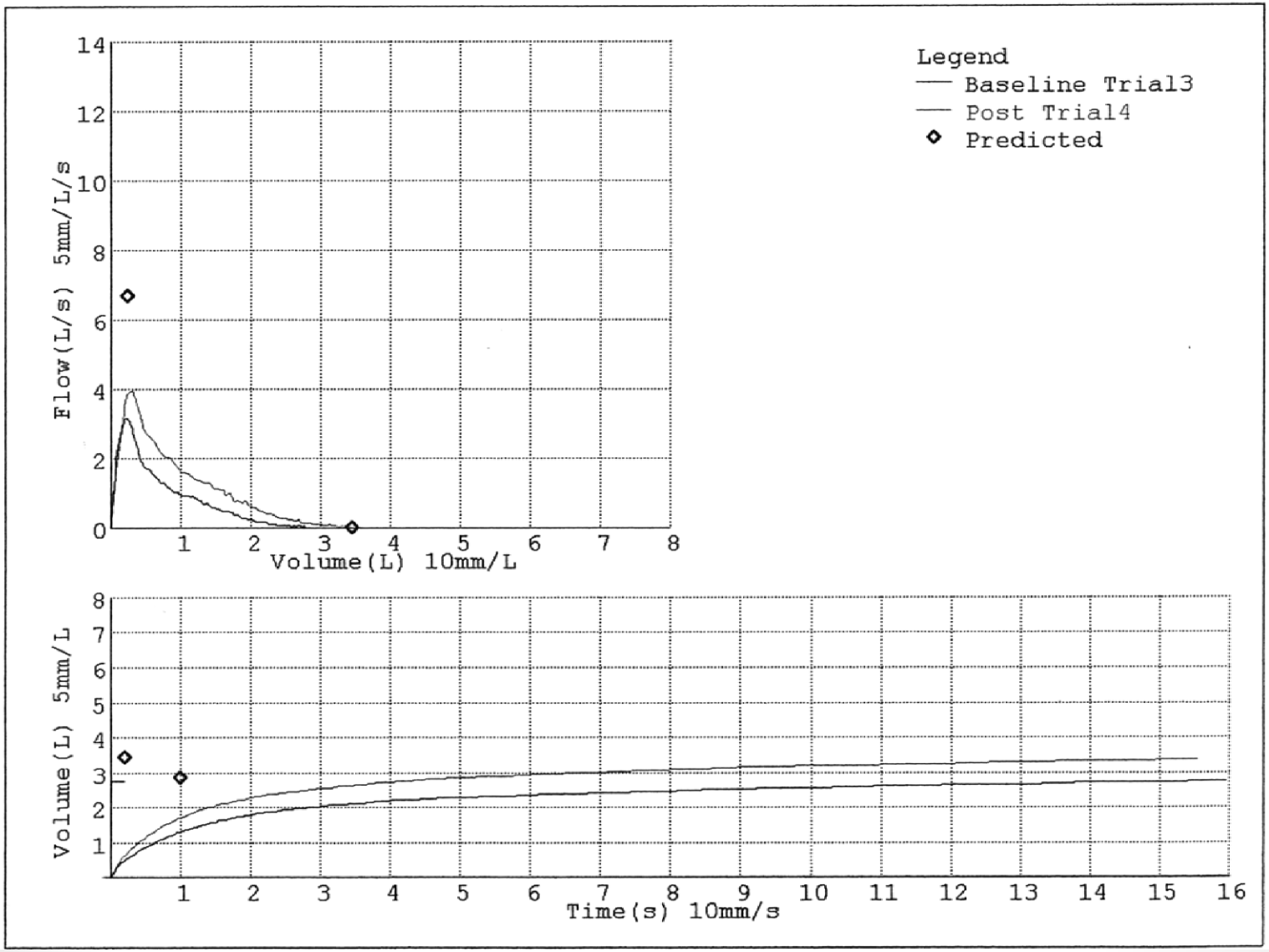
Case: BW - Plan of care

- SABA: Albuterol 2 inhalations PRN QID
- LABA/ICS high dose : Fluticasone/Salmeterol (500/50) 1 inh BID
- Control GERD: Esomeprazole 20 mg PO BID
- LTRA: Mometasone 10 mg PO daily
- Start drug assistance program to get meds on regular basis
- Confirm proper technique with all inhaler devices
- Avoid triggers and continue to stop smoking
- Get influenza vaccination each fall
- Get pneumococcal vaccination
- Provide Asthma Action Plan – cover exacerbations
- Discuss diet and exercise (weight loss?)
- Follow-up visit in 2 weeks

Case: MT

- 38 year old female: 5’2”, 119 lbs. Vital signs normal
  - No c/o cough or chest tightness
  - Wheezing 2-3 days/wk, more at night
  - Sleep: c/o some SOB at night
  - SOB occasionally with exertion (DOE)
  - Faint wheezes
- Smoked for a few months and quit
- No hospital or ED visits
- No loss of usual activities
- Allergies: NKDA but c/o sinus issues. Triggers: dog, dust
- Family: hx of asthma
- Using albuterol 2 inh PRN (used once a day for last several days

Case: MT (Pre/Post)



Case: MT

Patient Information

Name	Teaching case 1
ID	
Age	38
Height	5 ft 2 in
Weight	119 lbs, BMI 21.9
Gender	FEMALE
Ethnic	CAUCASIAN
Smoker	FORMER
Asthma	POSSIBLE

Test Information

Test Date	09:40am
Post Time	10:09am
Test Mode	DIAGNOSTIC
Interpretation	NLHEP
Predicted Ref	NHANES III
Value Select	BEST VALUE
Tech ID	
Automated QC	ON
BTPS (IN/EX)	-.--/ 1.04

Test Results Your FEV1 is 46% Predicted

	Baseline						Post				
Parameter	Best	Trial3	Trial2	Trial1	Pred	%Pred	Best	Trial4	Trial3	Trial1	Chg
FVC(L)	2.78*	2.78*	2.70*	2.47*	3.45	80	3.38	3.38	3.33	3.12	22%*
FEV1(L)	1.32*	1.32*	1.31*	1.20*	2.85	46	1.73*	1.73*	1.70*	1.60*	31%*
FEV1/FVC	0.48*	0.48*	0.49*	0.49*	0.83	58	0.51*	0.51*	0.51*	0.51*	
PEF(L/min)	188*	188*	179*	173*	400	47	235*	235*	224*	202*	25%*
FEF25-75(L/s)	0.48*	0.48*	0.47*	0.48*	3.08	16	0.65*	0.65*	0.66*	0.66*	36%*
FET(s)	16.21	16.21	16.15	10.74	-.--	--	15.57	15.57	15.62	13.18	

* Indicates Below LLN or Significant Post Change

Baseline	FEV1 Var=0.01L 0.8%;	FVC Var=0.08L 2.7%;	Session Quality A
Post	FEV1 Var=0.03L 1.9%;	FVC Var=0.04L 1.3%;	Session Quality A
Interpretation	Moderate Obstruction and Low vital Capacity possibly due to restriction		

FET Dropped ~4% but got 600 mL more in FVC

Conclusion

- Spirometry can provide an objective measurement of lung function and provide clues to discern several conditions (asthma, COPD, restrictive disorders)
- It takes trained personnel to be done properly and to troubleshoot issues for quality
- It can be done with very little capital invested but provides excellent tracking for pulmonary issues (billable procedure)

- Resources:
- AARC Clinical practice guidelines www.rcjournal.com/cpgs/index.cfm
- For COPD - www.goldcopd.com
- For Asthma - www.nhlbi.nih.gov/guidelines/asthma
- For Certified Asthma Educator credential (AE-C) - www.naecb.com

Thank you for listening

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